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(19)

(54) IMPROVEMENTS IN SEATS HAVING ADJUSTABLE BACKRESTS

(71) We, AUTOMOBILOVE ZAVODY, NARODNI PODNIK, a Czechoslovakian Body Corporate, of Mlada Boleslav, Czechoslovakia, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to seats having adjustable backrests enabling continuous adjustment of the slope of the seatback, and particularly to joints for such backrests.

There are known joints with an outer and an inner wheel forming cycloidal gearing, the tooth flanks having the form of epicycloids. These cycloidal wheels have nevertheless a disadvantageous feature in that the adjustment of the correct distance between the axes is critical, resulting in increased demands during the manufacture to set the eccentricity up precisely. Usually there are complications in assembly due to the fact that, in these mechanisms, it is necessary to use a full eccentric cylindrical guide for the mobile wheel and so the assembly of the joint must be performed from both sides which necessitates the use of a separate control knob. The manufacture of the gear by pressing is difficult because of the shape of the gear teeth and the service life of the joint is lower because of the relatively small radii of curvature of the cycloidal teeth.

According to the present invention there is provided a seat having an adjustable backrest connected to a seat rest by a joint comprising two parts hingedly connected together, the two parts being arranged to be rigidly connected to the backrest and the seat rest respectively, an externally-toothed gear disc secured to one of said parts, and an internally-toothed gear ring secured to the other of said parts, the number of teeth on the gear disc differing from the number of teeth on the gear ring by one tooth, the angular relationship between the backrest and the seat rest being adjusted by a relative rolling movement between the gear disc and the gear ring, wherein the gear disc and the gear ring have respective sinuous teeth profiles such that all the teeth of one of the two gears are always substantially in contact with those of the other when the gears are rolling, and wherein there is provided for effecting the rolling movement a guide member rotatable by and eccentrically located with respect to a driving shaft.

The sinuous teeth profiles may be of trochoidal form. However, conveniently the roots between adjacent teeth of the gear disc are shaped as arcs of a circle and the tips of the teeth of the gear ring are shaped as arcs of another circle of smaller radius than the first circle. Then, the tips of the teeth of the gear disc may be shaped according to an envelope generated by the position relative to a gear disc tooth adopted by a neighbouring tooth of the gear ring as the gears perform a complete rolling revolution. Conveniently also, the guide member is arranged such that the eccentric movement of one of the gear disc or the gear ring with respect to the other thereof is constrained by the guide member only in the direction parallel to the common tangent at the point of contact of the rolling circles of the two gears. (The motion of the two gears may be compared with that of one circle rolling inside another, the common tangent at the point of contact of the rolling circles being at right angles to the line of centres of the two gears.) Thus, in one preferred embodiment the guide member comprises two portions shaped as segments of a circle having their chords slidable on the driving shaft in two opposed recesses therein in a direction transverse to the axis of the shaft, the driving shaft being rotatably mounted in and coaxial with one of the gear ring or the gear disc and the

guide member being rotatably mounted in and coaxial with the other of the gear ring or the gear disc.

An advantage of the invention is that there is achieved a decrease of the stress of the eccentric guide and a simplification of the design and of the mounting of the joint of the adjustable seat back by the use of gear teeth having these sinuous profiles. The curved tooth profiles automatically set the distance between the axes of the gears and show also very advantageous features from the technological standpoint because they are formed with greater radii of curvature and in the case of the use of pressed gears the service life of the pressing tool is increased. Further, forming the previously mentioned portions of the teeth profiles as circular arcs enables the manufacture of the pressing tooth to be greatly simplified and the production costs decreased.

An example of a specific embodiment of a joint of an adjustable seatback constructed according to the invention, is shown on the accompanying drawing, in which:

Figure 1 shows the front view of the joint of the adjustable seatback in a sectional view,

Figure 2 is a sectional view through the plane C-C of Figure 1,

Figure 3 is a detail view of the gear teeth of the gear disc and gear ring,

Figure 4 shows a sectional view through the plane D-D of Figure 1.

The joint of a seat having an adjustable backrest comprises a gear disc 1 with external gear teeth formed on a lower arm 9 which is rigidly connected to the seat rest frame and a gear ring 2 with internal gear teeth formed on an upper arm 10 which is rigidly connected to the backrest frame. An axially located cylindrical driving shaft 3 passes through the centre of the disc 1 with the external gear teeth, and on the outer end of the shaft is fixed a control knob 5, an embellishment 13 covering the outer side of the shaft. The driving shaft is provided with two opposed recesses 11 in which are inserted segments 4 in the form of segments of a circle which transform the rotary motion of the driving shaft 3 into a circling motion of the ring 2 with the internal gear teeth. The axial location is provided by a collar 6 and by a spring retaining ring 7. Elastic members 8 and 12 are inserted between the outer faces of the gears 1 and 2 and the retaining ring 7 and the collar 6 respectively so as to take up the axial running clearance of the joint.

Rotary motion of the control knob 5 is transferred by means of the driving shaft 3 to the segments 4 and forces the ring 2 with the internal gear teeth to roll on the disc 1 with the external gear teeth. The ring 2 with the internal gear teeth partly rotates and partly performs a circling motion as a result of eccentricity *e*. The gear teeth on both the disc 1 and the ring 2 have sinuous profiles as shown in figures 2 and 3, and are designed such that the disc 1 with one gear tooth less than the ring 2 can roll round inside the ring 2 with each of its teeth remaining in contact with the neighbouring tooth of the ring 2. The roots between adjacent teeth of the gear disc 1 and the tips of the teeth of the gear ring 2, for the reasons of simplifying the manufacture of a pressing instrument and for increasing its service life, are formed as arcs of circles with radii r_1 and r_2. The tips of the teeth of the gear disc 1 between the points A and B are formed to match the envelopes formed by the mating profiles of the teeth of the ring 2 that arise through the rolling the two gears. The difference between such circular arcs and an ideal trochoidal profile for the teeth is a maximum of approximatetly 0.01 mm in the direction of a line normal to the curve of the tooth flanks as calculated on an automatic computer, for an eccentricity of 1 mm, which difference is, for the function of the mechanism, a negligible value. The mechanism of the invention exhibits one degree of freedom less than other known and similar designs in that the separation of the axes of the disc 1 and ring 2 is set automatically as a result of the sinuous teeth profiles. Therefore, a full eccentric guide for the ring 2 is not provided but a guide only exerting a force in the direction parallel to the tangent line *t* at the contact point of rolling circles k_1 and k_2 of the gears 1 and 2. This guide is, in this embodiment of the invention, formed by the two segments 4 in the form of segments of a circle which are seated in recesses 11 to be radially movable in a direction parallel to the line of centres of the rolling circles of the two gears. The recesses 11 prevent movement of the segments 4 in a direction perpendicular to the surfaces of the recesses 11 so that force is exerted on ring 2 in that direction. A positive setting of the separation of the axes of the two gears 1 and 2 by means of an eccentric cam to a magnitude *e* is not performed in the present device because this act is performed automatically as an effect of the features of the sinuous teeth profiles. Thus the assembly of the chair joint is simplified because the assembly of the individual parts may be performed from the side of one part only. There can be used a simple (in production) unitary control knob 5 which is rigidly connected with the driving shaft 3. The mechanism is therefore self-locking which means that the seatback can be adjusted to another position by a mere partial rotation of the control knob 5.

The stiffness of the backrest may be in-

creased by the use of a joint as described above on both sides of the backrest. The individual mechanism are then connected through a connecting rod that transfers the motion of the driving shaft 3 to the mechanism on the opposite side of the backrest.

The disc 1 with the external teeth is, in the described embodiment of the invention, fixedly joined to the seat frame and the ring 2 with the internal gear teeth is fixedly joined to the seatback frame which means that there occurs a rolling of the ring 2 on the disc 1. The kinematic opposite to this may be used, by fixedly joining the ring 2 with the internal gear teeth to the seat frame and the disc 1 with the external gear teeth to the seatback frame and to roll the disc 1 on the ring 2. This solution is nevertheless less suitable because the seatback will move in the opposite direction to the direction of the rotation of the control knob 5.

The joint for an adjustable backrest can be used in all types of seats, especially in the seats of automobiles.

Having regard to the Provisions of Section 9 of the Patents Act, attention is directed to the claims of Patents No. 1 091 994 and No. 1 180 848.

WHAT WE CLAIM IS:—

1. A seat having an adjustable bracket connected to a seat rest by a joint comprising two parts hingedly connected together, the two parts being arranged to be rigidly connected to the backrest and the seat rest respectively, an externally-toothed gear disc secured to one of said parts, and an internally-toothed gear ring secured to the other of said parts, the number of teeth on the gear disc differing from the number of teeth on the gear ring by one tooth, the angular relationship between the backrest and the seat rest being adjusted by a relative rolling movement between the gear disc and the gear ring, wherein the gear disc and the gear ring have respective sinuous teeth profiles such that all the teeth of one of the two gears are always substantially in contact with those of the other when the gears are rolling, and wherein there is provided for effecting the rolling movement a guide member rotatable by and eccentrically located with respect to a driving shaft.

2. A seat as claimed in claim 1 wherein the sinuous teeth profiles of the gears are of trochoidal form.

3. A seat as claimed in claim 1 wherein the roots between adjacent teeth of the gear disc are shaped as arcs of a circle and the tips of the teeth of the gear ring are shaped as arcs of another circle of smaller radius than the first circle.

4. A seat as claimed in claim 3 wherein the tips of the teeth of the gear disc are shaped according to an envelope generated by the positions relative to a gear disc tooth adopted by a neighbouring tooth of the gear ring as the gears perform a complete rolling revolution.

5. A seat as claimed in any preceding claim wherein the guide member is arranged such that the eccentric movement of the one of the gear disc or the gear ring with respect to the other thereof is constrained by the guide member only in the direction parallel to the common tangent at the point of contact of the rolling circles of the two gears.

6. A seat as claimed in claim 5 wherein the guide member comprises two portions shaped as segments of a circle having their chords slidable on the driving shaft in two opposed recesses therein in a direction transverse to the axis of the shaft, the driving shaft being rotatably mounted in and coaxial with one of the gear ring or the gear disc and the guide member being rotatably mounted in and coaxial with the other of the gear ring or the gear disc.

7. A seat as claimed in any preceding claim wherein the gear disc is secured to the part rigidly connected to the seat rest and the gear ring is secured to the part rigidly connected to the backrest.

8. A seat having an adjustable backrest substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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1372808 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet I

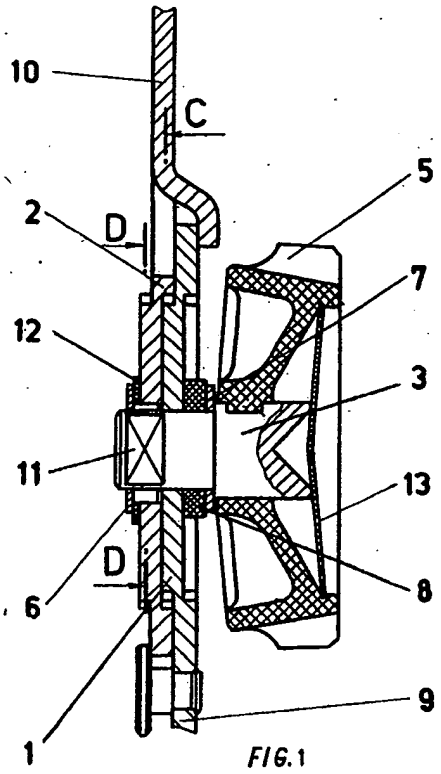

FIG.1

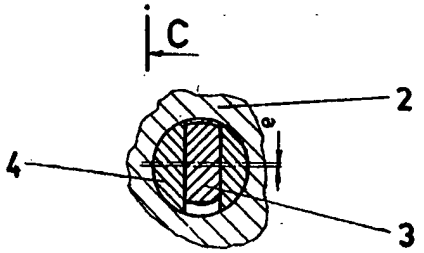

FIG.4.

1372808 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

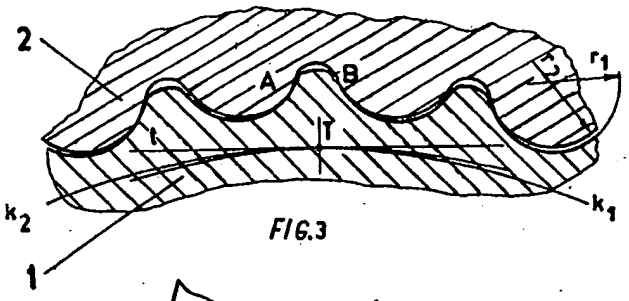

FIG.3

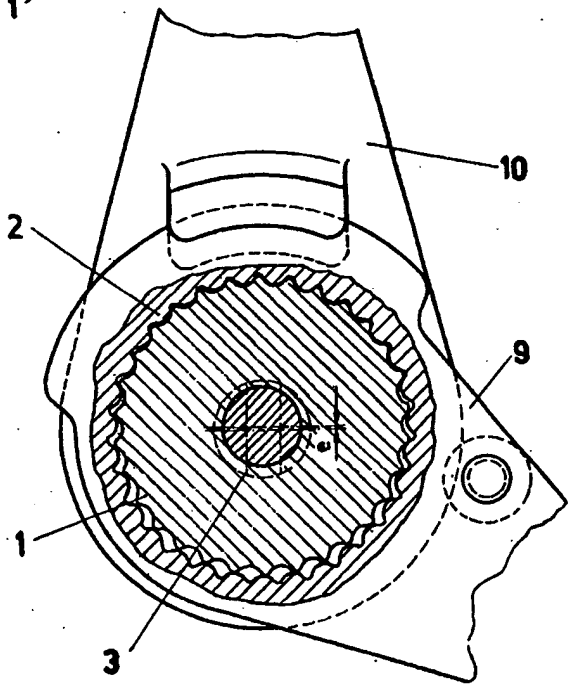

FIG. 2